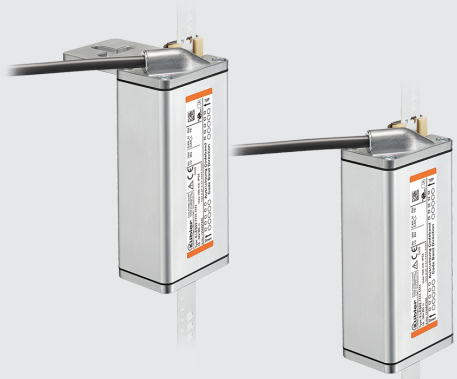
R67084.0002 - 01



Manual

LES02D

CAN

pulses for automation

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1 Document

This is the English translation of the original manual in German language.

Publisher	Kübler Group, Fritz Kübler GmbH Schubertstraße 47 78054 Villingen-Schwenningen Germany www.kuebler.com
Issue date	04/2024
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2 General Information

Please read this document carefully before working with the product, mounting it or starting it up.

2.1 Target Group

The device may only be planned, mounted, commissioned and serviced by persons having the following qualifications and fulfilling the following conditions:

- Technical training.
- Briefing in the relevant safety guidelines.
- Briefing in the operation by the machine operator.
- Constant access to this documentation.

2.2 Symbols used / Classification of the Warnings and Safety instructions

⚠ DANGER	**Classification:** This symbol, together with the signal word **DANGER**, warns against immediately imminent threat to life and health of persons. The non-compliance with this safety instruction will lead to death or severe adverse health effects.
⚠ WARNING	**Classification:** This symbol, together with the signal word **WARNING**, warns against a potential danger to life and health of persons. The non-compliance with this safety instruction may lead to death or severe adverse health effects.
⚠ CAUTION	**Classification:** This symbol, together with the signal word **CAUTION**, warns against a potential danger for the health of persons. The non-compliance with this safety instruction may lead to slight or minor adverse health effects.
ATTENTION	**Classification:** The non-compliance with the **ATTENTION** note may lead to material damage.

NOTICE	Classification: Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

2.3 Preliminary Remark

The following basic safety instructions are intended to avoid personal injuries and damage to property; they relate primarily to the use of the products described herein. If you additionally use further components, also consider their warnings and safety instructions.

2.4 Transport / Storage

Check the delivery immediately upon receipt for possible transport damages. If you do not mount the device immediately, store it preferably in its transport package.

The device must be stored at a dry and dust-free location, in compliance with the technical data, see chapter Technical Data [▷ 7].

2.5 Other Applicable Documents

NOTICE	Technical Data All technical data, as well as the mechanical and electrical characteristics, are specified in the data sheets of the corresponding device variant, for special versions in the.corresponding quotation / customer drawing of the product.

All documents such as the original declarations of conformity or the relevant certificates can be downloaded from our homepage:

www.kuebler.com/de/docu-finder

For the evaluation of the safe sensor, observe the respective operation manual of the system to be commissioned. The evaluation unit or control must comply with the requirements of the interface description and with the safety-related technical specifications.

3 Product Description

3.1 Functional description

LES02D

The sensor that is mounted on the elevator car and the coded band that is tensioned in the shaft form together the measuring system. The sensor converts a linear motion into a digital position signal. To this purpose, it evaluates the band, which is coded by two rows of holes.

3.2 Functional Specification

The electrical, electronic and programmable subsystem Safe Sensor LES02D may only be used in elevator facilities in conjunction with a suitable evaluation unit. The safety subsystem LES02D consists of the sensor and the coded band (stainless steel). The sensor LES02D reads the absolute position of the coded stainless steel band, which is mounted suspended in the shaft over the entire travel height. Band errors are recognized. The messages consisting of position, speed and error status are continuously transmitted every 4 ms via two redundant CAN bus communication links. Downstream evaluation unit(s) evaluate and process the messages. Together with this evaluation unit, an Elevator Directive-compliant electrical, electronic and programmable system can be achieved for safety-related applications in elevators.

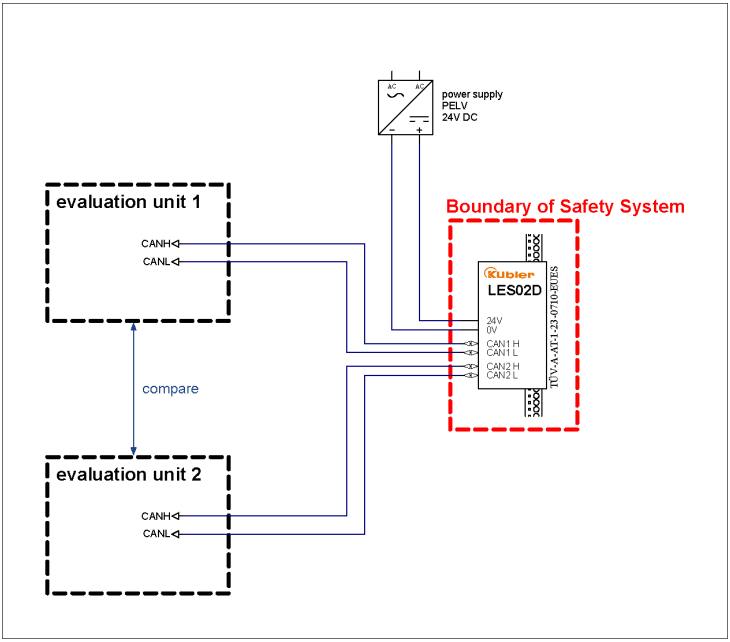

Fig. 1: Option 1: use with two evaluation units

IMG-ID: 27021598090242059

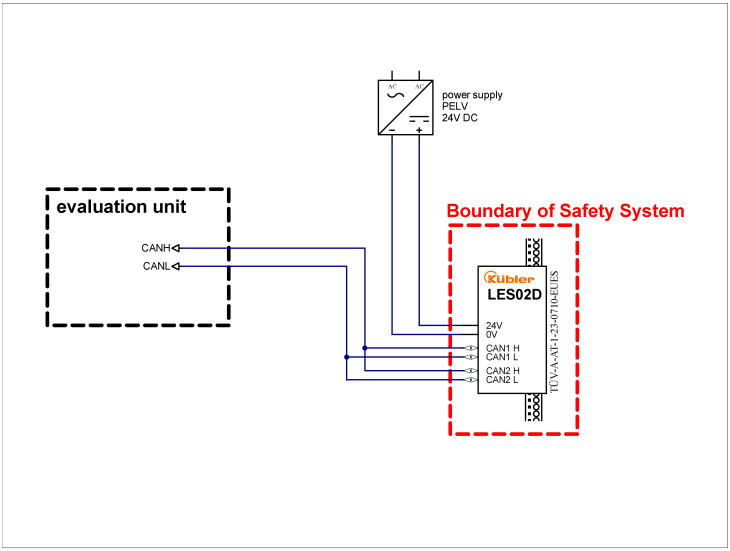

Fig. 2: Option 2: use with one evaluation unit

IMG-ID: 27021598090240139

What the measuring system does not fulfill

The following is not provided by the measuring system; this must be ensured by external devices:

- The measured position is not evaluated. This requires a safe evaluation unit or controller that will be able to fulfill various position-dependent safety functions.
- The measuring system in no way actively intervenes in the elevator system. It is purely a position sensor.
- The scope of the measuring system is not to measure lengths. Lengths vary in particular because of the temperature and other influencing factors.

3.3 Technical Data

NOTICE	**Technical Data**
	All technical data, as well as the mechanical and electrical characteristics, are specified in the data sheets of the corresponding device variant, for special versions in the.corresponding quotation / customer drawing of the product.

3.3.1 Sensor

Mechanical characteristics sensor

Operating temperature	-10°C ... +70 °C [14°F ... +158°F]
Storage temperature	-15°C ... +80 °C [5°F ... +176°F]
Protection level according to EN 60529	IP54
Maximum air humidity	<90 % (non-condensing)
Installation height	<2000 m [<6561 ft]
Material Housing	Aluminum
Weight	appr. 0,55 kg [1.213 lbs]
Maximum measuring length	392 m [1286 ft]
Maximum nominal speed of the elevator	8 m/s [26.25 ft/s]
Maximum speed	10,5 m/s [34.45 ft/s]
Resolution certified functional	 1 mm 0,5 mm
Accuracy position	±1 mm [±0.04"]
Speed tolerance	< 5 %

Electrical characteristics sensor

Supply voltage	10 ... 30 V DC
Supply voltage according to UL 1310	Class 2
Supply voltage	SELV / PELV
Maximum current consumption	100 mA
Protection class according to EN 61140	III

Sensor Connection Technology

Cable at the sensor	3 m
	0.25 mm² per wire
	Twisted pair
	shielded

Please note chapter Electrical Installation.

EMC- Electromagnetic compatibility

Relevant standard	EN 12015:2014 EN 12016:2013

3.4 Sensor Terminal Assignment

Interface	Cable, shielded, open cable end						
CAN	Signal:	+V	0 V/GND	CAN1_H	CAN1_L	CAN2_H	CAN2_L
	Wire color:	BN	WH	GN	YE	GY	PK

4 Commissioning and Operation

4.1 CAN communication

The prerequisite for understanding this first part of the chapter is advanced knowledge regarding the design, use, and evaluation of CAN buses as well as of bus protocols.

This section is not required for the proper installation and start-up of a certified evaluation unit. If the complete system is not functioning, the following section will provide possible fault diagnoses and corrective measures. In case of doubt please contact Technical Support [▷ 19].

Using the device with an external evaluation unit requires a definitive exchange protocol as presented in the following. An evaluation unit that wants to use the device must meet all requirements.

The complete system must be replaced if there is mechanical damage of any kind. The only exception is worn slide rails. The latter indicates a plant assembly error.

⚠ DANGER	**Evaluation unit safety functions** If position data is missing, the evaluation unit must guide the elevator system to a safe state using adequate means (and in dependence on the safety function. Whether operation can resume after a fault, i.e., a reset is permitted, is determined by the switch commands stored in the evaluation unit. Please follow the chapter “Functional Safety” in the operating instructions; refer to document R60109.

The device architecture stipulates that two independent channels (called Channel A and Channel B in the following) send alternating position data. ID number 0x0A is assigned to Channel A and 0x0B is assigned to Channel B. The CAN packets are 8 bytes log.

The meaning, timing, and other constraints are specified as follows. The 8 possible data bytes of a CAN message are numbered from 0 to 7, where 0 is chronologically first. The “0x“ prefix indicates hexadecimal numbers [▷ 17]. Data values not specified here are reserved for internal device purposes.

4.2 Data Transmission

Measure	Description
Alternating sending by channels	In normal operation, each channel sends its data every 4 ms. Channel B synchronizes to the half interval of Channel A, so that data packets are sent every 2 ms.
Data must be checked for plausibility	The evaluation unit checks the positions for plausibility in order to detect transmission errors unable to be captured by the CAN protocol (depending on the SIL of the complete system).
Specified CAN ID Use	The CAN IDs are used in the 11 bit standard. Channel A always receives ID 0x0A, Channel B ID 0x0B.
Only LES may send via CAN bus	Only the LES sensor can send messages using the CAN bus. The sending of LES reset commands by the evaluation unit is the only exception. If an invalid message is detected an error is output and the sensor locked.

4.3 Data telegram design

4.3.1 Data telegrams during the start sequence

After switch-on, in the start sequence both channels send two startup telegrams.

NOTICE	**Identifying startup telegrams** The startup telegram can be identified on bit 8 of byte 0 and may not be evaluated by the evaluation unit like data telegrams.

Telegram with CRC of the sensor software:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0xA0	CRC MSB	CRC	CRC	CRC LSB	FF	80	01

Telegram with the software version of the sensor software:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0xA0	SW MSB	SW	SW	SW LSB	FF	80	08

4.3.2 Data telegrams during operation

Error status			Speed		Position		
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
Error 23 - 16	Error 15 - 8	Error 7 - 0	Speed MSB	Speed LSB	Pos MSB	Pos	Pos LSB

4.4 Supported commands

In case of an error the bus channels can each be deleted using a reset command. If the error occurs again, carry out the steps in section Failures [▶ 15].

Command		Description
ID	**Data**	
0x7F0	00 0A 01 E2 C9 05 00 17	Reset Channel A
0x7F0	00 0A 01 C2 C9 05 00 17	Reset Channel B

NOTICE	**Resetting an error state** The error state for one channel can be deleted using the reset command for the channel in question, or by briefly disconnecting the power supply for both channels.

4.5 Status LED

A LED signals the status of the device:

Display	LED	Meaning
LED off		No voltage
LED green (5 s)		Initialization after switching on
LED green flashing		BUS communication available on both channels
LED red flashing		An error occurred, the output data is no longer safe

4.6 CAN Error Codes

In general, the sensor cannot be repaired. A defective device requires full replacement.

NOTICE	**Safety component traceability**
	Please note that the device is generally a subsystem of a safety system, and therefore the traceability of safety components has to be ensured. Therefore, record which device (serial number) is replaced by which new device (new serial number).

Several measures have to be carried out if an error occurs that can be traced back to the sensor. For error detection, the error can be read using the connected evaluation unit (for details refer to the corresponding operating instructions).
Causes of error and measures to be carried out:

Worn slide rails (critical error):
In this exceptional case only the slide rails may be replaced (see above). Since forces do not impact the slide rails when installed correctly, worn slide rails indicate an installation error.

- Check that the code band is installed perpendicular and firmly clamped. It has to run through the sensor on the slide rail without pressure.

Dirt on the code band and dirt released from there in the sensor (less common error):

- Check and clean the code band.
- While unplugged, clean the sensor with compressed air.
- Wait one minute before connecting the device again.

⚠ CAUTION	**Behavior in case of error**
	After each error that sets the device to lock state, it is mandatory to drive through the complete length of the elevator shaft in normal operation without problems. Only then can be elevator be released again. If errors occur again, the cause has to be investigated. If standard corrective measures are insufficient, then replacement of the complete unit is necessary. If mechanical parts of the device are bent or battered, then the device must be replaced. In addition, check how a mechanical load on the device was possible given that, in normal operation, no forces are to impact the device (except weak friction from the band).

Designation	Bit number	Category	Possible cause
Error on another channel	0	Warning / info	The other channel has an error.
Advance warning for position deviation.	1	Warning	Dirt on band and possibly sensor (resets when there is movement).
Advance warning for position imprecision.	2	Warning	Dirt on band and possibly sensor, release sometimes reduced (still only 2-6 mm) (resets when there is movement).
Code band error when switching on the LES02D.	3	Error	Dirt on band and possibly sensor (can happen at beginning).
Measurement of clock track not possible (small holes).	4	Error	Slide rails, band guide, sensor possibly defective.
Missing code band.	5	Error	No band.
Internal error.	6	Error	Sensor defective.
Inclination error	7	Error	Installation, collision
Faulty position data.	8	Error	Dirt on band and possibly sensor, sensor defective.
Internal error.	9	Error	Error on another channel (was reset), sensor defective.
Internal error.	10	Error	Sensor defective.
BUS error.	11	Error	Incorrect CAN cabling, other invalid CAN participants, sensor defective.
Internal error.	12	Error	Sensor defective.
Acceleration values implausible.	13	Error	Installation, collision, sensor possibly defective.
Code track measurement (large holes).	14	Error	Dirt on band and possibly sensor, sensor defective.
Installation error.	15	Error	Sensor installed incorrectly.
Excessive speed.	16	Error	Speed above 10.5 m/s.
Internal error.	17	Error	Sensor defective.
Internal error.	18	Error	Sensor defective.
Internal error.	19	Error	Sensor defective.
Internal error.	20	Error	Sensor defective.
	21		
Acceleration too high.	22	Error	Free fall detected, sensor possibly defective.
Identifying startup telegram.	23	Info	Bit that was set during startup, no error but the rest of the data must not be interpreted.

4.7 Failures

The measurement system does not communicate with the controller.

a) Check the supply voltage.

b) Check that the electrical installation is correct, especially the wiring.

c) Ensure that the connection to the CAN bus is installed properly. If necessary, use a CAN monitor to check data transmission.

d) Ensure that the evaluation unit is compatible with the sensor.

e) After the sensor is installed, make sure the code band direction matches the direction specified on the sensor identification plate (direction of large and small holes).

f) Inspect the slide rails for serious wear.

g) In case of an error, reset the sensor if necessary.

5 Disposal

Always dispose of unusable or irreparable devices in an environmentally sound manner, according to the country-specific provisions and in compliance with the waste disposal regulations in force. We will be glad to help you dispose of the devices.

See chapter Contact [▶ 19].

NOTICE	**Environmental damage in case of incorrect disposal**
	Electrical waste, electronic components, lubricants and other auxiliary materials are subject to hazardous waste treatment. Problem substances may only be disposed of by licensed specialist companies.

Dispose of disassembled device components as follows:

- Metal components in the scrap metal.
- Electronic components in the electrical waste.
- Plastic parts in a recycling center.
- Sort and dispose of the other components depending on the material type.

6 Annex

6.1 Decimal / Hexadecimal conversion table

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	*0x0*	51	*0x33*	102	*0x66*	153	*0x99*	204	*0xCC*
1	*0x1*	52	*0x34*	103	*0x67*	154	*0x9A*	205	*0xCD*
2	*0x2*	53	*0x35*	104	*0x68*	155	*0x9B*	206	*0xCE*
3	*0x3*	54	*0x36*	105	*0x69*	156	*0x9C*	207	*0xCF*
4	*0x4*	55	*0x37*	106	*0x6A*	157	*0x9D*	208	*0xD0*
5	*0x5*	56	*0x38*	107	*0x6B*	158	*0x9E*	209	*0xD1*
6	*0x6*	57	*0x39*	108	*0x6C*	159	*0x9F*	210	*0xD2*
7	*0x7*	58	*0x3A*	109	*0x6D*	160	*0xA0*	211	*0xD3*
8	*0x8*	59	*0x3B*	110	*0x6E*	161	*0xA1*	212	*0xD4*
9	*0x9*	60	*0x3C*	111	*0x6F*	162	*0xA2*	213	*0xD5*
10	*0xA*	61	*0x3D*	112	*0x70*	163	*0xA3*	214	*0xD6*
11	*0xB*	62	*0x3E*	113	*0x71*	164	*0xA4*	215	*0xD7*
12	*0xC*	63	*0x3F*	114	*0x72*	165	*0xA5*	216	*0xD8*
13	*0xD*	64	*0x40*	115	*0x73*	166	*0xA6*	217	*0xD9*
14	*0xE*	65	*0x41*	116	*0x74*	167	*0xA7*	218	*0xDA*
15	*0xF*	66	*0x42*	117	*0x75*	168	*0xA8*	219	*0xDB*
16	*0x10*	67	*0x43*	118	*0x76*	169	*0xA9*	220	*0xDC*
17	*0x11*	68	*0x44*	119	*0x77*	170	*0xAA*	221	*0xDD*
18	*0x12*	69	*0x45*	120	*0x78*	171	*0xAB*	222	*0xDE*
19	*0x13*	70	*0x46*	121	*0x79*	172	*0xAC*	223	*0xDF*
20	*0x14*	71	*0x47*	122	*0x7A*	173	*0xAD*	224	*0xE0*
21	*0x15*	72	*0x48*	123	*0x7B*	174	*0xAE*	225	*0xE1*
22	*0x16*	73	*0x49*	124	*0x7C*	175	*0xAF*	226	*0xE2*
23	*0x17*	74	*0x4A*	125	*0x7D*	176	*0xB0*	227	*0xE3*
24	*0x18*	75	*0x4B*	126	*0x7E*	177	*0xB1*	228	*0xE4*
25	*0x19*	76	*0x4C*	127	*0x7F*	178	*0xB2*	229	*0xE5*
26	*0x1A*	77	*0x4D*	128	*0x80*	179	*0xB3*	230	*0xE6*
27	*0x1B*	78	*0x4E*	129	*0x81*	180	*0xB4*	231	*0xE7*
28	*0x1C*	79	*0x4F*	130	*0x82*	181	*0xB5*	232	*0xE8*
29	*0x1D*	80	*0x50*	131	*0x83*	182	*0xB6*	233	*0xE9*
30	*0x1E*	81	*0x51*	132	*0x84*	183	*0xB7*	234	*0xEA*

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
31	*0x1F*	82	*0x52*	133	*0x85*	184	*0xB8*	235	*0xEB*
32	*0x20*	83	*0x53*	134	*0x86*	185	*0xB9*	236	*0xEC*
33	*0x21*	84	*0x54*	135	*0x87*	186	*0xBA*	237	*0xED*
34	*0x22*	85	*0x55*	136	*0x88*	187	*0xBB*	238	*0xEE*
35	*0x23*	86	*0x56*	137	*0x89*	188	*0xBC*	239	*0xEF*
36	*0x24*	87	*0x57*	138	*0x8A*	189	*0xBD*	240	*0xF0*
37	*0x25*	88	*0x58*	139	*0x8B*	190	*0xBE*	241	*0xF1*
38	*0x26*	89	*0x59*	140	*0x8C*	191	*0xBF*	242	*0xF2*
39	*0x27*	90	*0x5A*	141	*0x8D*	192	*0xC0*	243	*0xF3*
40	*0x28*	91	*0x5B*	142	*0x8E*	193	*0xC1*	244	*0xF4*
41	*0x29*	92	*0x5C*	143	*0x8F*	194	*0xC2*	245	*0xF5*
42	*0x2A*	93	*0x5D*	144	*0x90*	195	*0xC3*	246	*0xF6*
43	*0x2B*	94	*0x5E*	145	*0x91*	196	*0xC4*	247	*0xF7*
44	*0x2C*	95	*0x5F*	146	*0x92*	197	*0xC5*	248	*0xF8*
45	*0x2D*	96	*0x60*	147	*0x93*	198	*0xC6*	249	*0xF9*
46	*0x2E*	97	*0x61*	148	*0x94*	199	*0xC7*	250	*0xFA*
47	*0x2F*	98	*0x62*	149	*0x95*	200	*0xC8*	251	*0xFB*
48	*0x30*	99	*0x63*	150	*0x96*	201	*0xC9*	252	*0xFC*
49	*0x31*	100	*0x64*	151	*0x97*	202	*0xCA*	253	*0xFD*
50	*0x32*	101	*0x65*	152	*0x98*	203	*0xCB*	254	*0xFE*
								255	*0xFF*

7 Contact

You want to get in touch with us:

Technical advice

For technical advice, analysis or support during installation, Kübler is directly on site with its globally active application team.

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Repair service / RMA-Form

For returns, please pack the product adequately and enclose the completed "Returns Form".

www.kuebler.com/rma

Send your return, specifying the RMA-reference, to the following address.

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www.kuebler.com

Glossary

CAN

Controller Area Network

CAN-ID

CAN Identifier - Assembled messages identifier per device

CRC

Cyclic Redundancy Check

EN 60529

Degrees of protection provided by enclosures (IP Code)

EN 12015

Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks - Emission

EN 12016

Electromagnetic compatibility - Product family standard for lifts, escalators and moving walks - Immunity

EN 61140

Protection against electric shock - Common aspects for installation and equipment

LED

Light Emitting Diode. Semiconductor component that emits light.

LES

Linear Encoder Safe

LSB

engl. Least Significant Bit

MSB

engl: Most Significant Bit

RMA

Return Material Authorization, authorization to return material, e.g. in the case of complaints.

SIL

Safety Integrity Level

UL

Underwriters Laboratories (Inc.). US organization for the certification of electrotechnical products

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